Plant Assessment Form

For use with the "Criteria for Categorizing Invasive Non-Native Plants that Threaten Wildlands" by the California Exotic Pest Plant Council and the Southwest Vegetation Management Association (Warner et al. 2003)

Printable version, February 28, 2003
(Modified for use in Arizona, 07/02/04)

Table 1. Species and Evaluator Information

Species name (Latin binomial)**:**	*Cortaderia selloana* (J.A. & J.H. Schultes) Aschers. & Graebn. (USDA 2005)
Synonyms:	*Cortaderia dioica* (Spreng.) Speg. (USDA 2005)
Common names:	Pampas grass, Uruguayan pampas grass, silver pampas grass, tussock grass
Evaluation date (mm/dd/yy)**:**	04/29/04
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Committee review date:	10/22/04 and 12/17/04
List date:	12/17/04
Re-evaluation date(s):	

Table 2. Scores, Designations, and Documentation Levels

Question		Score	Documentation Level	Section Scores	Overall Score & Designations
1.1	Impact on abiotic ecosystem processes	**B**	Other published material	**"Impact"** **Section 1 Score:** **B**	**"Plant Score"** **Overall Score:** **Medium** **Alert Status:** **None**
1.2	Impact on plant community	**B**	Reviewed scientific publication		
1.3	Impact on higher trophic levels	**C**	Reviewed scientific publication		
1.4	Impact on genetic integrity	**D**	Other published material		
2.1	Role of anthropogenic and natural disturbance	**B**	Other published material	**"Invasiveness"** *For questions at left, an A gets 3 points, a B gets 2, a C gets 1, and a D or U gets=0. Sum total of all points for Q2.1-2.7:* **15 pts** **Section 2 Score:** **B**	
2.2	Local rate of spread with no management	**B**	Observational		
2.3	Recent trend in total area infested within state	**B**	Observational		
2.4	Innate reproductive potential	**A**	Other published material		
2.5	Potential for human-caused dispersal	**B**	Other published material		
2.6	Potential for natural long-distance dispersal	**B**	Reviewed scientific publication		
2.7	Other regions invaded	**B**	Other published material		RED FLAG YES Something you should know.
3.1	Ecological amplitude	**A**	Observational	**"Distribution"** **Section 3 Score:** **B**	
3.2	Distribution	**D**	Observational		

Red Flag Annotation

Cortaderia selloana is widely sold as both a live plant or seed in Arizona and on the internet. It also is promoted as a low water-use plant in Arizona. As a relatively new plant to Arizona, *C. selloana* has only started to appear in wildlands. Based on the species broad ecological ecological amplitude, it potentially can become as problematic in Arizona as it now is in California and other places. At present *C. selloana*

exists only in small patches in the state; however, plenty of unoccupied niches, such as riparian corridors, are available to this species to invade.

Table 3. Documentation

Question 1.1 Impact on abiotic ecosystem processes *Score:* **B** *Doc'n Level:* **Other pub.**
Identify ecosystem processes impacted: Pampas grass alters fire regimes. Deep root systems can change the soil water table level and cause geomorphological changes in river systems and deltas where it establishes on banks.
Rationale: In New Zealand and Australia where infestations are dense, pampas grass creates a fire hazard and increases fire frequencies with excessive build up of dry leaf litter and flowering stalks (Gadgil et al. 1984). By introducing fire to habitats that are not adapted, or increasing the frequencies of these events, native plants are disadvantaged through the alteration of competitive interactions caused by changes in resource availability. A single plant can occupy a soil area of about 1,100 square feet (103 m^2). Lateral roots can spread to thirteen feet (4 m) in diameter and eleven and one-half feet (3.5 m) in depth (DiTomaso 2000). This extensive perennial root system has the potential to change hydrological regimes. In New Zealand, pampas grass is used for erosion control (Gadgil et al.1984). It was planted by the Soil Conservation Service in 1946 (in Ventura and Los Angeles Counties) for soil erosion purposes (Costas-Lippmann 1977).
Sources of information: See cited literature.

Question 1.2 Impact on plant community composition, structure, and interactions *Score:* **B** *Doc'n Level:* **Rev. sci. pub.**
Identify type of impact or alteration: Pampas grass competes with native vegetation communities in natural areas, and in ruderal habitats such as logged forest, where they inhibit natural succession.
Rationale: From Gadgil et al. (1984): Although no reliable data on pampas productivity is tree stands exist, pampas grass clearly has considerable potential for competing with trees for moisture and nutrients (New Zealand). Examination of nutrient levels in pampas grass leaves in New Zealand revealed high levels of nitrogen, and tree growth is limited by nitrogen availability. In New Zealand sand dune forests a perennial tree lupin (*Lupinus arboreus*) supplies the nitrogen required for other tree growth through biological fixation, and is likely to be reduced when in the presence of pampas grass. Pampas grass commonly suppresses growth in young trees, and although growth retardation in older trees is suspected, no quantitative data exist. A study by Costas-Lippman and Baker (1980) found that *Cortaderia selloana* showed greater genetic diversity than *C. jubata*, another non-native species that invades California, New Zealand, and Australia. This may explain the ability of *C. selloana* to use water more efficiently by tolerating water stress during drought and ability to utilize water when it was plentiful (Lambrinos 2002, Costas-Lippman and Baker 1980). The presence of *C. jubata* individuals can significantly enhance the probability of future *Cortaderia* establishment. *Cortaderia* individuals already present in the Califronia landscape may greatly accelerate the conversion of native vegetation into *Cortaderia* dominated gasslands (Lambrinos 2002) Seedling survival is low in shaded areas or in competition with grasses and sedges (Gadgil et al. 1990, DiTomaso 2000). Although logged forest is considered disturbed ruderal habitat, populations of pampas grass inhibit the natural succession process and prevent the establishment of new trees (Lambrinos 2001, Gadgil et al. 1984). In New Zealand, it competes with and smothers other vegetation. It creates a fire hazard with excessive build-up of dry material (dry leaves, leaf bases and flowering stalks). Impacted in particular are plants growing in rocklands e.g. coastal cliffs, coastal dunes etc (Haley 1997; no empirical evidence was cited).

Observations by J. Agyagos (personal communication, 2004) suggest that pampas grass is displacing native species based on a monoculture with a 16 feet diameter in Dead Horse State Park.
Sources of information: See cited literature. Also considered personal communication with J. Agyagos (Wildlife Biologist, U.S. Department of Agriculture, Forest Service, Coconino National Forest, Red Rock Ranger District, 2004).

Question 1.3 Impact on higher trophic levels *Score:* **C** *Doc'n Level:* **Rev. sci. pub.**
Identify type of impact or alteration: Pampas grass provides habitat for exotic mice and rats in New Zealand. Rabbits feed on the seedlings in coastal scrub sites in California, which prohibits the expansion and colonization of pampas grass in these areas. Pampas grass is grazed by cattle in Australia.
Rationale: Pampas grass provides habitat for rats in New Zealand that predate birds and eggs and eat the fruits and seeds of forest plants, which prevents forest regrowth (Harradine 1991, New Zealand Department of Conservation website, 2004). In an experimental study, Lambrinos (2002) found that the invasive potential of pampas grass is "strongly moderated" by generalist herbivores in chaparral coastal sage scrub in California.
Sources of information: See cited literature. Also considered information from the New Zealand Department of Conservation website (available online at: http://www.doc.govt.nz/Conservation/003~Weeds/Pampas-Grass.asp; accessed May 2004).

Question 1.4 Impact on genetic integrity *Score:* **D** *Doc'n Level:* **Other pub.**
Identify impacts: No known hybridization.
Rationale: There are no native species of *Cortaderia* in Arizona.
Sources of information: Kearney and Peebles (1960).

Question 2.1 Role of anthropogenic and natural disturbance in establishment *Score:* **B** *Doc'n Level:* **Other pub.**
Describe role of disturbance: Pampas grass establishes readily in disturbed areas. This species may occasionally establish in undisturbed areas but readily establishes with natural and anthropogenic disturbances.
Rationale: In New Zealand, pampas grass invasion is accelerated by disturbance and threatens the productivity of plantation forests and land of high conservation value. It has the ability to reach distant open spaces quickly and to blanket them with very rapid growth. Native turfland communities can be quickly overcome by the invasion of pampas. Pampas invades disturbed areas such as cleared bush margins, burned areas and firebreaks (New Zealand Department of Conservation website, 2004). Soil disturbance favors colonization (Gadgil et al. 1984). In a study by Lambrinos (2002) in California, *Cortaderia selloana* seeds emergence were enhanced by soil disturbance (mechanically turning the soil) at a seasonal wetland, and maritime chaparral, but not in dune scrub sites. Based on herbarium records and new censuses in California, Lambrinos (2001) found that *C. selloana* has expanded at a greater rate than *C. jubata* but also a greater proportion of its populations have colonized relatively undisturbed native plant communities compared to *C. jubata.* McKinnon (1984) notes that pampas grass does not appear to succeed on undisturbed ground cover.
Sources of information: See cited literature. Also considered information from the New Zealand Department of Conservation website (available online at: http://www.doc.govt.nz/Conservation/003~Weeds/Pampas-Grass.asp; accessed May 2004).

Question 2.2 Local rate of spread with no management *Score:* **B** *Doc'n Level:* **Obs.**
Describe rate of spread: Increasing, but less rapidly than doubling in <10 years.
Rationale: Based on observations at Dead Horse State Park it is spreading downstream (J. Agyagos,

personal communication, 2004). In California the invasiveness of C. selloana has increased over time, whereas that of C. jubata has remained relatively constant (Lambrinos 2002).

Sources of information: Personal communication with J. Agyagos (Wildlife Biologist, U.S. Department of Agriculture, Forest Service, Coconino National Forest, Red Rock Ranger District, 2004).

Question 2.3 Recent trend in total area infested within state *Score:* **B** *Doc'n Level:* **Obs.**

Describe trend: Increasing, but less rapidly than doubling its range in <10 years.

Rationale: A study by Lambrinos (2001) on the expansion history of *C. selloana* in California showed that the invasiveness of this species increased over time, occupying more vegetation types and non-ruderal habitats than closely related *C. jubata,* which were both introduced to California in the mid-1800s. In the case of *C. selloana*, populations have expanded spatially at twice the rate of asexual species *C. jubata*. The lag time from the point at which the species was introduced and when it began to naturalize and spread spatially was less than 50 years, demonstrating the need to control Arizona's relatively low-level infestation now.

Sources of information: See cited literature citations. Score based on Working Group member observations and inference.

Question 2.4 Innate reproductive potential *Score:* **A** *Doc'n Level:* **Other pub.**

Describe key reproductive characteristics: Pampas grass is a perennial that reproduces sexually via seeds and cuttings. Produces large amount of seeds.

Rationale: Pampas grass produces a copious amount of small seeds, as much as one million/individual. Seed production occurs over two to three months in late summer and early fall (Lambrinos 2002). Seeds lack dormancy (Costas-Lippmann 1977 in Lambrinos 2002). The taxonomy of this species is often confused with *C. jubata,* which looks almost identical in appearance but the population is all female and it is obligate apomixic, whereas the population of *C. selloana* is dioecious and it is an obligate outcrosser (Lambrinos 2002). Vegetative reproduction can occur when moisture reaches fragmented tillers and develop adventitious roots at the base of the shoot. Plants can live for up to fifteen years (DiTomaso 2000). Can propagate by seeds or from root division (Starr et al. 2003). Capable of flowering after one to two years and has a life span of 10 to 15 years (Cowan 1976). In the nursery industry, pampas grass is also propagated through division of mature plants.

Sources of information: See cited literature.

Question 2.5 Potential for human-caused dispersal *Score:* **B** *Doc'n Level:* **Other pub.**

Identify dispersal mechanisms: Pampas grass is sold and planted as an ornamental grass (pink and white varieties). Seed is also available for sale on the internet. The blooms are also used in dried floral arrangements (Starr et al. 2003). Used for erosion control and cattle fodder (Lemon and Taylor 1949 in Starr et al. 2003, Gadgil et al. 1984).

Rationale: Pampas grass is currently sold as ornamental plants by nurseries on the internet, and in cities like Page, Arizona. Originally introduced to the U.S. (California) as an ornamental and initially populations did not escape or grow rapidly, but after a period of nearly 50 years, pampas grass has spread north and south down and up the coast and naturalized in many habitats.

It is propagated by division of mature plants. In recent years, however, some nurseries have propagated pampas grass from seed. Originally female plants were selected for but since propagation from seed was initiated and male and female plants are not distinguishable before they flower, the result is an increase in the proportion of male plants in the population. Consequently, there has been an increase in the amount of viable seed produced and the species has escaped to become an invasive problem along the California coast (DiTomaso et al. 1999).

Sources of information: See cited literature; also see Lambrinos (2001) and DiTomaso (2000).

Question 2.6 Potential for natural long-distance dispersal *Score:* **B** *Doc'n Level:* **Rev. sci. pub.**
Identify dispersal mechanisms: Pampas grass seeds travel on the wind and in flowing water.
Rationale: The light seeds are carried by wind to new areas, and transported by water along river margins. Primarily wind dispersed (Lambrinos 2002). Seeds are light and capable of long distance dispersal. "At maturity seed-bearing female florets of *C. selloana* are quite readily wind-borne, and distribution can be effective over quite some distance. Winds need not be strong to be effective in dispersal, as slight updraughts can raise the florets quite markedly. Seed-bearing florets from hermaphrodites, however, tend to fall directly to the ground and dispersal is very restricted" (Connor 1973). In New Zealand pampas grass infestations have been found on the Hen and Chicken Islands, more than 30 kilometers away from the main island, suggesting the wind blown seeds can be carried by wind long distances (McKinnon 1984). In California both *C. selloana* and *C. jubata* expanded in a pattern consistent with populations establishing by long-distance dispersal (natural or anthroprogenic) and then expanded independent of each other (Shigesada and Kawaskai 1997 in Lambrinos 2001).
Sources of information: See cited literature; also see DiTomaso (2000).

Question 2.7 Other regions invaded *Score:* **B** *Doc'n Level:* **Other pub.**
Identify other regions: This species invades two ecological types that exist, but are not yet invaded in Arizona. Pampas grass invades dunes and wetlands in California.
Rationale: From DiTomaso (2000): Pampas grass is native to Argentina, Brazil and Uruguay, where it grows in damp soils along river margins. It was first introduced into Europe by a Scottish horticulturist between 1755 and 1862. Pampas grass is also a weed problem in other areas of the world, naturalizing across New Zealand and Australia. It is listed as an invasive pest plant in New Zealand, Australia, South Africa, and Hawai'i (Starr et al. 2003). Pampas grass came to California as an ornamental plant and commercial production for the nursery trade began in 1874. It was also planted by the Soil Conservation Service as dryland forage and to prevent erosion in 1946. In California populations of *C. selloana* now occur in more vegetation types and more non-ruderal habitats than *C. jubata* (Lambrinos 2002). It is reported from the coastal habitats of Oregon. In New Mexico it is reported from Bernalillo and eight southern New Mexico counties. The Grass Manual on the Web reports *C. selloana* in southern Nevada, southern New Mexico, northern Utah, and central Washington.
Sources of information: See cited literature; also see the Grass Manual on the Web (available online at: http://www.herbarium.usu.edu/webmanual/default.htm).

Question 3.1 Ecological amplitude *Score:* **A** *Doc'n Level:* **Obs.**
Describe ecological amplitude, identifying date of source information and approximate date of introduction to the state, if known: First record from Arizona is from 1960 (an ornamental plant from the University of Arizona campus [SEINet 2004]). Pampas grass grows in subhumid and semi-arid subtropical regions in open sunny places receiving added moisture, becoming naturalized as a weed in damp places, depressions, along stream banks, the margins of mangrove swamps and, in particular, disturbed areas associated with roads, pipeline cuts and walking trails in forest areas and waste places. Pampas grass can tolerate winter frost, warmer summer temperatures, more intense sunlight and moderate drought. In California, pampas grass is found in mesic habitats such as the upper vegetation zone of tidal wetlands as well as the inland riparian habitats of the San Francisco Bay delta region (Lambrinos 2001). *Cortaderia selloana* is more abundant in xeric plant communities than *C. jubata* and thus appears to

have broader ecological tolerances (Lambrinos 2002). The distribution of *C. selloana* across vegetation types is more diverse and demonstrates greater genetic variability that of *C. jubata*. These results are consistent with the hypothesis that genetic variability enables better utilization of heterogeneous habitats, as well as promoting greater competitive abilities (Lambrinos 2001).

Rationale: This species is widespread, invading three major Arizona ecological types (see Worksheet B). It also persists in abandoned and waste areas (J. Agyagos, personal communication, 2004).

Sources of information: See cited literature; also see DiTomaso (2000) and Costas-Lippman (1977). Also considered information from SEINet (Southwest Environmental Information Network), Arizona herbaria specimen database (available online at: http://seinet.asu.edu/collections; accessed December 2004) and personal communication with J. Agyagos (Wildlife Biologist, U.S. Department of Agriculture, Forest Service, Coconino National Forest, Red Rock Ranger District, 2004). Score based on observations of numerous individuals (see question 3.2 below).

Question 3.2 Distribution *Score:* **D** *Doc'n Level:* **Obs.**

Describe distribution: In Arizona pampas grass herbarium specimens were collected from Highway 179 near the junction of 89A, at the junction of Interstate 17 and the Verde River 500 feet from the river, from Lake Powell, Wahweap Marina, and from city parks in Pima (Tumomoac Hill) and Maricopa County.

It was also collected from Grand Canyon National Park, just upstream of Diamond Creek along the river edge in 2003. In 2004 one plant was removed from side canyon in upper portion of Colorado River during September 2004 (K. Watters, personal communication, 2004). One plant removed from Cienega Creek (Bureau of Land Management land) during restoration work (D. Turner, personal communication, 2004). A population of pampas grass is present for approximately ¾ of a mile along the active stream channel of the Verde River in Dead Horse State Park (J. Brock and J. Agyagos, personal communications, 2004).

A couple of plants in Glen Canyon National Recreation Area up on a rock wall that is difficult to get to; been there approximately 12 years. One plant in the corridor upstream from Lee's Ferry (J. Spence, personal communication, 2004). Hasn't been seen in Oak Creek Canyon (J. Agyagos, personal communication, 2004).

Rationale: This species has a limited distribution in Arizona. Numbers at present are fairly low and populations are scattered to just a few individuals.

Sources of information: SEINet (Southwest Environmental Information Network), Arizona herbaria specimen database (available online at: http://seinet.asu.edu/collections; accessed September 2004) and personal communications with K. Watters (Research Technician, National Park Service, Southern Colorado Plateau Network, Flagstaff, Arizona, 2004), D. Turner (Conservation Planner, The Nature Conservancy, Tucson. Arizona, 2004), J. Brock (Professor, Applied Biological Science, Arizona State University-East, Mesa, Arizona, 2004), J. Agyagos (Wildlife Biologist, U.S. Department of Agriculture, Forest Service, Coconino National Forest, Red Rock Ranger District, 2004), and J. Spence (Botanist, National Park Service, Glen Canyon National Recreation Area, 2004).

Worksheet A. Reproductive Characteristics

Complete this worksheet to answer Question 2.4.

Reaches reproductive maturity in 2 years or less	**Yes**	**No**	**1 pt.**
Dense infestations produce >1,000 viable seed per square meter	**Yes**	**No**	**2 pt.**
Populations of this species produce seeds every year.	**Yes**	**No**	**1 pt.**
Seed production sustained for 3 or more months within a population annually	**Yes**	**No**	**1 pt.**
Seeds remain viable in soil for three or more years	**Yes**	**No**	**2 pt.**
Viable seed produced with *both* self-pollination and cross-pollination	**Yes**	**No**	**1 pt.**
Has quickly spreading vegetative structures (rhizomes, roots, etc.) that may root at nodes	**Yes**	**No**	**1 pt.**
Fragments easily and fragments can become established elsewhere	**Yes**	**No**	**2 pt.**
Resprouts readily when cut, grazed, or burned	**Yes**	**No**	**1 pt.**

Total pts: 8 Total unknowns: 2

Score : A

Note any related traits: DiTomaso (2000) indicated that fire is not a long term control method because the plants resprout shortly thereafter (not sure if this is considered equivalent to "readily").

Worksheet B. Arizona Ecological Types

(*sensu* Brown 1994 and Brown et al. 1998)

Major Ecological Types	Minor Ecological Types	Code*
Dunes	dunes	
Scrublands	Great Basin montane scrub	
	southwestern interior chaparral scrub	
Desertlands	Great Basin desertscrub	**D**
	Mohave desertscrub	
	Chihuahuan desertscrub	
	Sonoran desertscrub	**D**
Grasslands	alpine and subalpine grassland	
	plains and Great Basin shrub-grassland	
	semi-desert grassland	
Freshwater Systems	lakes, ponds, reservoirs	
	rivers, streams	
Non-Riparian Wetlands	Sonoran wetlands	
	southwestern interior wetlands	
	montane wetlands	
	playas	
Riparian	Sonoran riparian	**D**
	southwestern interior riparian	**D**
	montane riparian	
Woodlands	Great Basin conifer woodland	**D**
	Madrean evergreen woodland	
Forests	Rocky Mountain and Great Basin subalpine conifer forest	
	montane conifer forest	
Tundra (alpine)	tundra (alpine)	

*A means >50% of type occurrences are invaded; B means >20% to 50%; C means >5% to 20%; D means present but ≤5%; U means unknown (unable to estimate percentage of occurrences invaded).

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